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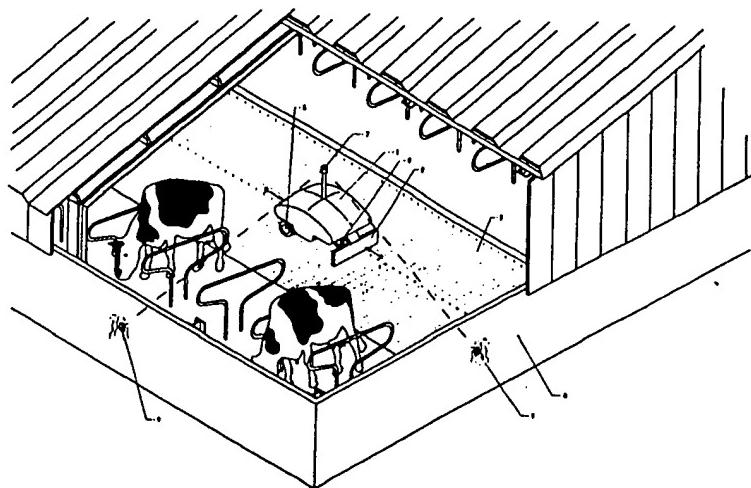
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### (54) Apparatus for cleaning a stable

(57) The invention relates to an apparatus (1) for cleaning a stable, comprising a cleaning slide (2) which, during use is arranged such as to be movable in the aisle (3) of a cattle shed (4), and which is provided with a control unit (8) and a motor drive for moving, under control of the control unit, the cleaning slide in the aisle, the control unit (8) being connected with sensor means (7) and the control unit (8) comprising control logic for emitting a sensor means-dependent control signal to the motor drive. The apparatus for cleaning a stable is equipped as an autonomically movable vehicle (1) onto

which the cleaning slide (2) is mounted, and which is provided with wheel members (5,6), at least one (6) of which wheels being adjustable for determining the vehicle's direction, that the vehicle (1) is provided with means (7) for determining its position in the cattle shed (4), and that the control unit (8) is equipped with a memory for storing data about the cattle shed (4), the position of the vehicle (1) in the cattle shed (4), and a plan of the route along which the vehicle (1) is to move in the cattle shed (4).



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**Description**

[0001] The invention relates to an apparatus for cleaning a stable, comprising a cleaning slide which, during use is arranged such as to be movable in the aisle of a cattle shed, and which is provided with a control unit and a motor drive for moving, under control of the control unit, the cleaning slide in the aisle, the control unit being connected with sensor means and the control unit comprising control logic for emitting a sensor means-dependent control signal to the motor drive.

[0002] Such an apparatus for cleaning a stable is known from the German Patent DE-C-44.44.508. This publication discloses a method and an apparatus for cleaning a stable in which a slide is moved to and fro over the entire width of the aisle of the cattle shed. The slide moves by means of a chain connected with the slide, which is coupled to drive means in the cattle shed.

[0003] With the known apparatus, the method is realized in a manner such that the slide movement is interrupted when and as soon as a cow comes in front of the slide. After a short interval the sliding motion recommences, moving to and fro until the cow has moved and the cleaning motion of the slide can be continued.

[0004] A drawback of this known apparatus is that the slide will always have to be made to fit into the aisle in which it is to be used, this involves relatively high installation costs. It is therefore not possible to standardize such a cleaning apparatus. An additional drawback is that the known cleaning apparatus is only suitable for cleaning the aisle, while other parts in the cattle shed are just as much in need of regular cleaning.

[0005] The Dutch patent 1002487 discloses a construction for cleaning a stable for animals such as cows, in which movable cleaning means are used with the aid of which the stable floor can be cleaned selectively. The cleaning means comprise a manure suction installation which is suspended from the ceiling of the stable such as to be movable along it via a rail construction.

[0006] The apparatus for cleaning a stable according to the invention is characterized in that the apparatus for cleaning a stable is equipped as an autonomically movable vehicle onto which the cleaning slide is mounted, and which is provided with wheel members, at least one of which wheels being adjustable for determining the vehicle's direction, that the vehicle is provided with means for determining its position in the cattle shed, and that the control unit is equipped with a memory for storing data about the cattle shed, the position of the vehicle in the cattle shed, and a plan of the route along which the vehicle is to move in the cattle shed. Such a vehicle may be designed such that it can also easily move to places other than the aisle, in particular also to places that are relatively narrow. The route plan of the vehicle can then simply be adjusted to the possibilities the vehicle offers for cleaning such inconveniently accessible places in the cattle shed.

[0007] It is noted that the German Offenlegungsschrift

DE-A1-9 614 916 and the American patent specifications US-A-5 204 814 and US-A-5 440 216 disclose automatically movable vehicles or robots with a cleaning or floor treatment function. However, these publications relate to vehicles that are not equipped to clean cattle sheds.

[0008] In a further aspect of the apparatus for cleaning a stable in accordance with the invention, said apparatus is characterized in that the means for determining the position of the vehicle in the cattle shed are selected from the group comprising laser means, infrared means, radiographical means, induction means. This also comprises, for instance, the global positioning system G.P.S. By these means the vehicle can perform an absolute determination of position in the cattle shed as a control on the cleaning route to be completed; these means can also be applied such that an incremental change in the vehicle's position in the cattle shed is registered. In the latter case it is also desirable that the possibility of calibration exist in respect of the position of the vehicle in the cattle shed. An advantageous embodiment of this will be explained below.

[0009] To optimize the determination of the vehicle's position in the cattle shed it is desirable that the means for determining the position of the vehicle in the cattle shed collaborate with markers positioned in the cattle shed. To enhance the precision of the determination of the vehicle's position in the cattle shed it is desirable that the means for determining the position of the vehicle in the cattle shed comprise recorders connected with the wheels for registering the number of revolutions of the wheels and the position of the wheel that determines the vehicle's direction. By combining the respective positioning data, said provisions, together with the means for determining the vehicle's position in the cattle shed mentioned earlier, will result in optimized position determination. It is, however, also possible to use the means for determining the position of the vehicle discussed above individually.

[0010] The vehicle according to the invention may be fed, for example, via a live wire netting provided in the cattle shed and under which the vehicle moves. The supply voltage can then be taken off by means of a sliding contact against the wire netting.

[0011] It was already indicated above that preferably means are provided for the calibration of the vehicle's position in the cattle shed. A particularly favourable embodiment of this kind is characterized in that the vehicle is provided with an energy storage unit for the motor drive, and that while the energy storage unit is connected with a charging device provided in the cattle shed, the vehicle's position stored in the memory is adjusted to a preselected absolute value that represents the position of the charging device in the cattle shed. It is also desirable that at least the front and rear of the vehicle be provided with sensor means for the perception of an obstacle such as a cow, another animal or a person.

[0012] According to yet another aspect of the invention, the control unit is equipped to register the energy level in the energy storage unit, so that if the energy level falls below a preset value, the control unit will direct the vehicle to the charging device. This makes it possible to provide a fully automated apparatus for cleaning a stable, which includes the vehicle that is part thereof.

[0013] The invention will now be explained in more detail with reference to the drawing which represents in a single figure a perspective view of the apparatus for cleaning a stable according to the invention.

[0014] The apparatus for cleaning a stable 1 is provided with a cleaning slide 2. The apparatus for cleaning a stable 1 is arranged such as to be movable in the aisle 3 of a cattle shed 4, by being equipped as an autonomically movable vehicle 1 onto which the cleaning slide 2 is mounted.

[0015] The cleaning slide may be selected from various kinds of manure slides, such as combislide, grid slide, folding slide, slotted slide and hill and valley-slide any other suitable slide. These slides are known to the expert and require no further explanation.

[0016] The vehicle 1 is provided with wheel members 5 and 6, of which wheel 6 is adjustable to allow the vehicle 1 to be steered. Further, the vehicle 1 is provided with means for determining its position in the cattle shed. These means carry reference number 7 and may be selected from the group comprising laser means, infrared means, radiographical means, among which G.P.S., and induction means. For example, in the case of induction means an induction loop may be provided in the cattle shed 4, defining the route along which the vehicle 1 is to be moved through the cattle shed 4.

[0017] The wheel members are driven by a motor drive incorporated in the vehicle 1. The motor drive is controlled by a control unit 8. The control unit 8 is further equipped with a memory unit for storing data about the cattle shed such as the length and the width of the aisle 3. The memory unit further serves for registering the actual position that the vehicle 1 is occupying in the cattle shed 4 and to adjust the same to the movements undertaken by the vehicle 1 in concurrence with or in deviation of the route plan which is also stored in the memory and according to which the vehicle 1 is supposed to move in the cattle shed 4.

[0018] To increase the precision of the system for determining the position the vehicle 1, or at least the means for determining the position of the vehicle 1, can collaborate with markers positioned in the cattle shed. A few markers are indicated with reference number 9 in the cattle shed 4. Such markers 9 act, for example, as reflector for the signals emitted by the means 7. In order to be able to extract the directional component from said signals, the means 7 will emit the signals unidirectionally, not omnidirectionally. The direction in which the signals are emitted is then adjustable. Furthermore, the vehicle 1 may be equipped such that the wheels 5, 6 are coupled with recorders for registering the number of rev-

olutions of the wheels 5, 6 make and the position of the wheel 6 determining the vehicle's direction. In addition it is desirable that means be provided for the calibration of the memory-stored position of the vehicle 1 in the cattle shed. This memory is part of the control unit 8. Preferably the vehicle 1 is provided with an energy storage unit for the motor drive of the wheels 5, 6. The vehicle's 1 position in the cattle shed, stored in the memory, may then preferably be related to a charging device for the energy storage unit provided in the stable 4, such that while the energy storage unit of the vehicle 1 is connected with a charging device provided in the cattle shed 4, the vehicle's position stored in the memory is adjusted to a preselected absolute value which represents the position of the charging device.

[0019] The vehicle 1 is at least at the front and rear (in the Figure indicated by arrows A and B, respectively) provided with sensor means for the perception of an obstacle such as a cow. Furthermore, the control unit 8 is equipped to register the energy level in the energy storage unit 10, so that if the energy level falls below a preset value, the control unit 8 will direct the vehicle 1 to the charging device provided in the cattle shed 4.

[0020] To the expert it will be obvious that the preceding specification relates only to a few possible embodiments of the apparatus for cleaning a stable according to the invention, and that diverse variations are conceivable which are all deemed to be within the scope of the appended claims.

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#### Claims

1. An apparatus for cleaning a stable, comprising a cleaning slide which, during use is arranged such as to be movable in the aisle of a cattle shed, and which is provided with a control unit and a motor drive for moving, under control of the control unit, the cleaning slide in the aisle, the control unit being connected with sensor means and the control unit comprising control logic for emitting a sensor means-dependent control signal to the motor drive, characterized in that the apparatus for cleaning a stable is equipped as an autonomically movable vehicle onto which the cleaning slide is mounted, and which is provided with wheel members, at least one of which wheels being adjustable for determining the vehicle's direction, that the vehicle is provided with means for determining its position in the cattle shed, and that the control unit is equipped with a memory for storing data about the cattle shed, the position of the vehicle in the cattle shed, and a plan of the route along which the vehicle is to move in the cattle shed.
2. An apparatus for cleaning a stable according to claim 1, characterized in that the means for determining the position of the vehicle in the cattle shed are selected from the group comprising laser

means, infrared means, radiographical means and induction means.

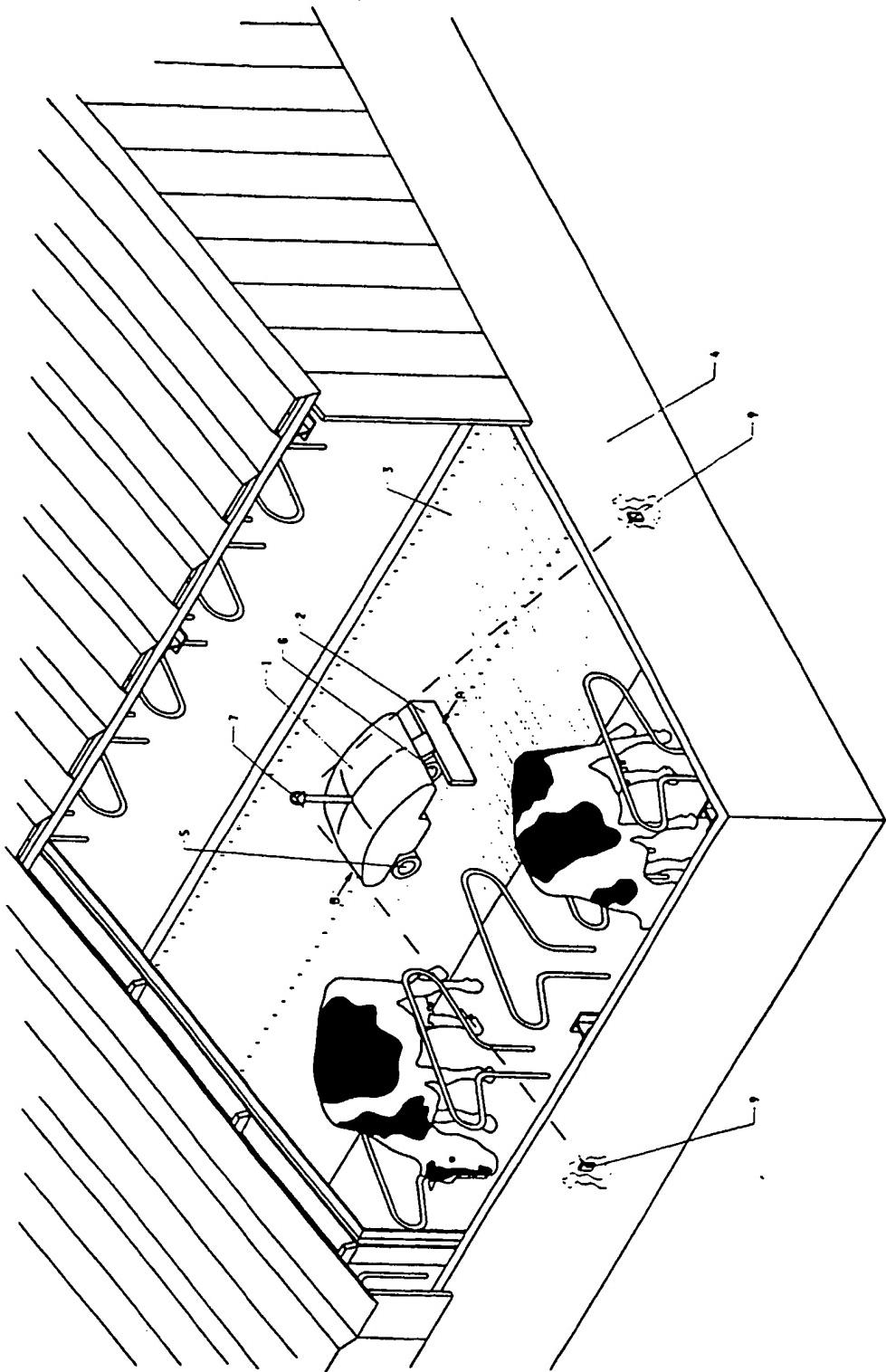
3. An apparatus for cleaning a stable according to claim 2, **characterized** in that the means for determining the position of the vehicle in the cattle shed collaborate with markers positioned in the cattle shed. 5
4. An apparatus for cleaning a stable according to one of the claims 1-3, **characterized** in that the means for determining the position of the vehicle in the cattle shed comprise recorders connected with the wheels for registering the number of revolutions of the wheels and the position of the wheel that determines the vehicle's direction. 10 15
5. An apparatus for cleaning a stable according to one of the claims 1-4, **characterized** in that means are provided for the calibration of the memory-stored position of the vehicle in the cattle shed. 20
6. An apparatus for cleaning a stable according to one of the preceding claims, **characterized** in that the vehicle is provided with an energy storage unit for the motor drive, and that while the energy storage unit is connected with a charging device provided in the cattle shed, the vehicle's position stored in the memory is adjusted to a preselected absolute value that represents the position of the charging device in the cattle shed. 25 30
7. An apparatus for cleaning a stable according to one of the claims 1-6, **characterized** in that at least the front and rear of the vehicle be provided with sensor means for the perception of an obstacle such as a cow, another animal or a person. 35
8. An apparatus for cleaning a stable according to one of the claims 1-7, **characterized** in that the control unit is equipped to register the energy level in the energy storage unit, so that if the energy level falls below a preset value, the control unit will direct the vehicle to the charging device. 40

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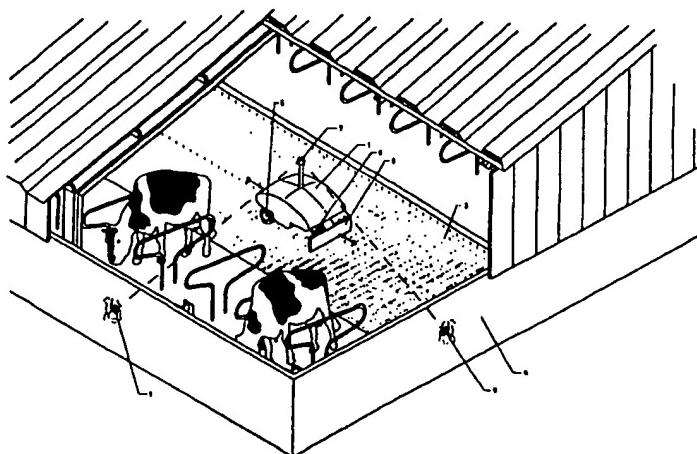
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## EUROPEAN SEARCH REPORT

Application Number  
EP 99 20 0827

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	4 October 1999	von Arx, V.	
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